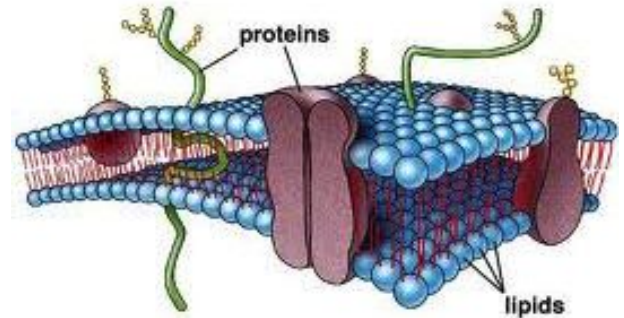


MCAS REVIEW 2: BIOCHEMISTRY AND CELL BIOLOGY PART 2

CELL TRANSPORT

- CELL MEMBRANES

- Made up of a **phospholipid bilayer** and **proteins**
 - Proteins used to move things in and out of the cell (*facilitated diffusion* and *active transport*)
- **Selectively permeable** = only allows certain things in and out of the cell



PASSIVE TRANSPORT

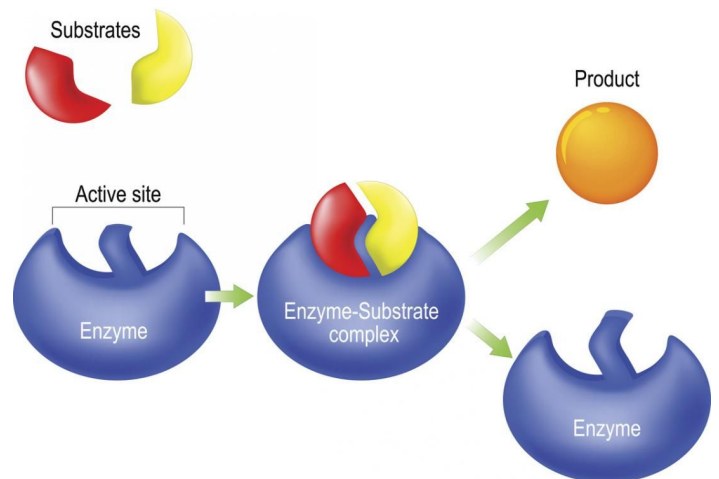
DIFFUSION	OSMOSIS
Natural movement of particles from areas of high concentration to areas of low concentration	= Diffusion of water
Does not require energy	Does not require energy

ACTIVE TRANSPORT

- Movement of particles **against the concentration gradient** from areas of low concentration to high concentration
- Requires **ENERGY**

ENZYMES

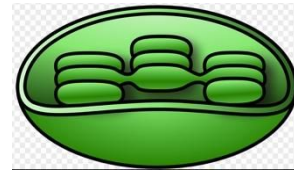
- Enzymes are **catalysts**
 - Enzymes **speed up reactions or increase the rate of reactions** in the body by lowering the activation energy of the reaction
- Enzymes stop working (**denature**) in extreme changes in temperatures or pH (how acidic a solution is)
- Enzymes are **proteins**



PHOTOSYNTHESIS: ONLY IN PLANTS!!!

- Takes place in **CHLOROPLASTS**
 - o Chlorophyll absorbs light energy
- Takes light energy from the sun and converts it into glucose (sugar)
- Uses CO₂ and releases O₂

- $\text{CO}_2 + \text{H}_2\text{O} + \text{Light energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$
- Carbon dioxide + Water + light Energy \rightarrow Glucose + Oxygen



CELLULAR RESPIRATION: PLANTS AND ANIMALS!

- Takes place in **MITOCHONDRIA**
- Takes glucose and converts it into useable energy (**ATP**) for cell
- Uses O₂ and releases CO₂

- $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{ATP energy}$
- Glucose + Oxygen \rightarrow Carbon dioxide + Water + ATP energy



ATP

- o ATP = energy molecule!!!! It stores and releases energy.
- o Structure = adenosine attached to 3 phosphates
 - When one phosphate is removed, energy is released!

CELL CYCLE

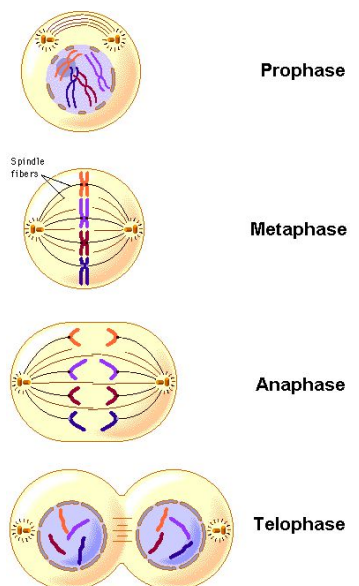
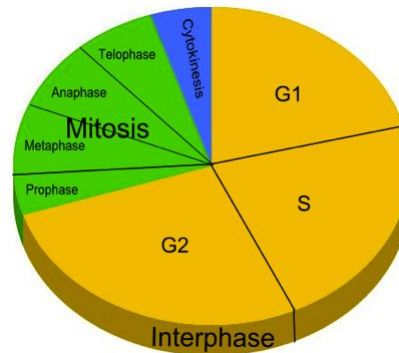
- INTERPHASE

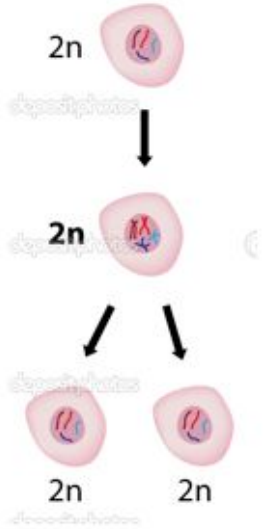
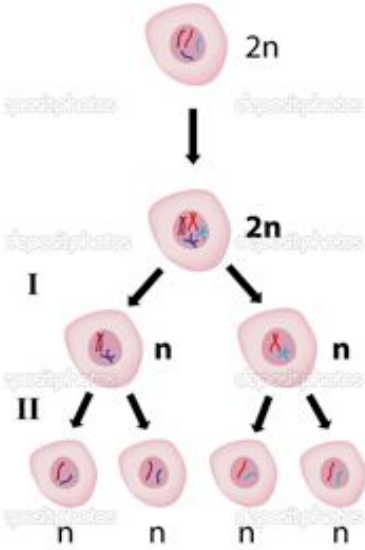
- o **G1** Phase = cell grows
- o **S** Phase = DNA replication
- o **G2** Phase = prepare for cell division

- MITOSIS

- o M Phase = (divided into PMAT)
 - **P**rophase = chromosomes become visible, spindle forms
 - **M**etaphase = chromosomes line up in middle of the cell
 - **A**naphase = spindle pulls chromosomes apart
 - **T**elophase = nuclear envelope begins to form

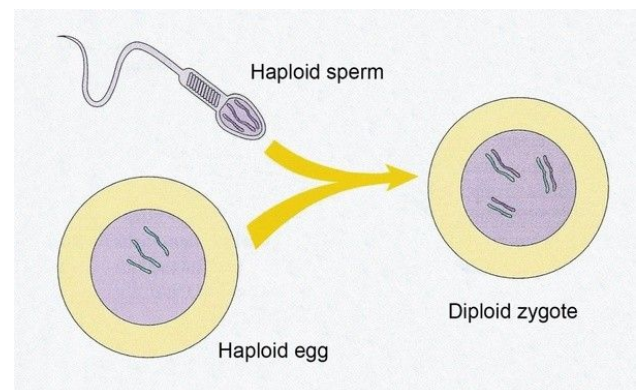
- **CYTOKINESIS** = pinching of cytoplasm to split cells



Mitosis = <i>asexual reproduction</i>	Meiosis
Forms 2 identical daughter cells to parent cell	Forms 4 non-identical daughter cells
Forms two diploid cells	Forms four haploid cells
Makes <i>somatic (body)</i> cells (<i>skin, bone, etc.</i>)	Makes <i>gametes (sex cells: sperm and egg)</i>
<p>(start) (end) 1 diploid cell → 2 diploid cells</p> 	<p>(start) (end) 1 diploid cell → 4 haploid cells</p> 
<p>One division only</p>	<p>Two divisions: Meiosis I and Meiosis II Tetrad = homologous chromosomes paired up Crossing over = homologous chromosomes exchanging genes during Meiosis I Independent Assortment: Chromosomes randomly separated into different gametes</p>

SEXUAL REPRODUCTION

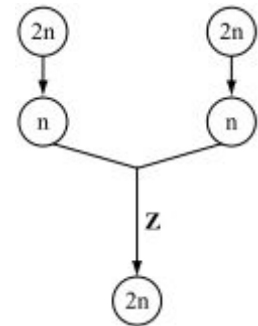
- **Fertilization:** Gametes formed from meiosis join together (sperm with egg) to form a zygote.
 - o *Haploid egg + haploid sperm = diploid zygote*
- Half of the genes in the zygote come from the mother, and half from the father, but they will not look identical to their parents.



PRACTICE QUESTIONS

- Which of the following normally results from meiosis in a human cell that contains 46 chromosomes?
 - an egg cell with 46 chromosomes
 - a liver cell with 23 chromosomes
 - a blood cell with 46 chromosomes
 - a sperm cell with 23 chromosomes
- Which of the following statements describes the role of ATP in animal cells?
 - ATP stores and releases energy.
 - ATP forms the channels in the plasma membrane.
 - ATP serves as the hereditary material in the nucleus.
 - ATP attaches to and digests unneeded organic molecules.
- A cell membrane has a double layer of molecules. These molecules are made up of a phosphorus-containing “head” and two long, fatty acid “tails.” Which of the following **best** explains why the molecules are classified as lipids?
 - They contain phosphorus.
 - They form a double layer.
 - They are made up of fatty acids.
 - They are found in the cell membrane.

- The diagram to the right represents steps in sexual reproduction.



Which of the following occurs in the step labeled **Z**?

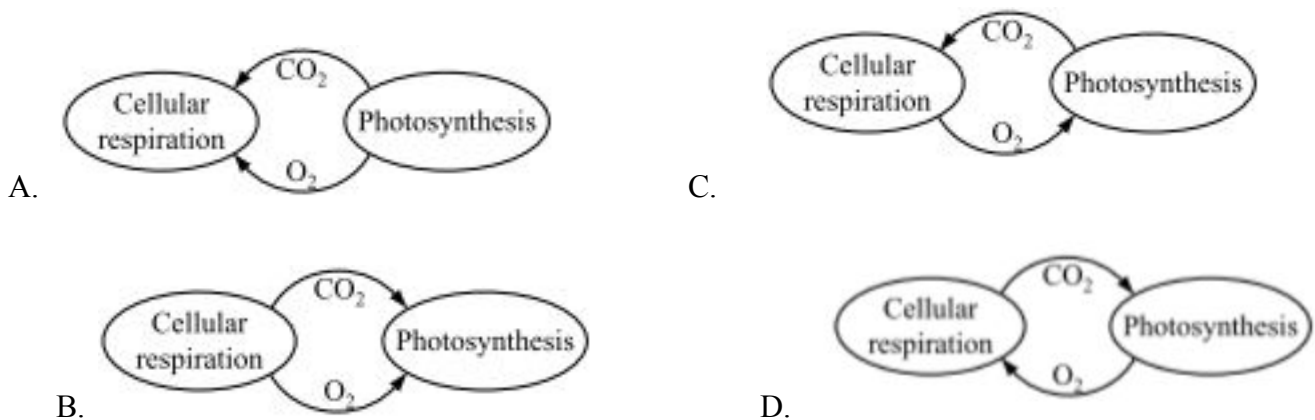
- fertilization
 - Meiosis
 - Mitosis
 - Translocation
- The human body regularly sheds and replaces its skin cells. Which of the following processes is directly responsible for replacing these cells?
 - Mitosis
 - Meiosis
 - Osmosis
 - Translation
 - If an animal cell is placed in distilled water, it will swell and burst. The bursting of the cell is a result of which biological process?
 - Active Transport
 - Enzyme Activity
 - Osmosis
 - Respiration

7. Which of the following statements describes a difference between photosynthesis and cellular respiration in plants?
- Photosynthesis occurs only during the day, whereas cellular respiration occurs only at night.
 - Photosynthesis involves only one reaction, whereas cellular respiration involves many steps.
 - Photosynthesis occurs only in cells containing chlorophyll, but cellular respiration occurs in all cells.
 - Photosynthesis converts light energy into chemical energy, but cellular respiration converts light energy into heat energy.
8. Plants in floodplains often get covered by water during floods. Some plants survive the floods because they can continue photosynthesis underwater. However, the plants' rates of photosynthesis are much lower underwater than above water.

Which of the following helps to explain why the rates of photosynthesis are lower underwater than above water?

- There is too much oxygen in the water.
 - There is no carbon dioxide in the water.
 - The chloroplasts do not function underwater.
 - The available light is less intense underwater.
9. Which of the following **most likely** happens in the cells of a person running in the Boston Marathon?
- The respiration rate increases to produce more ATP.
 - The replication rate increases to produce more DNA.
 - The photosynthesis rate increases to produce more sugars.
 - The cell division rate increases to produce more muscle fibers.

10. Which of the following diagrams accurately represents the use of gases in both cellular respiration and photosynthesis?



11. The products of photosynthesis are carbohydrates and oxygen. Which process uses these substances as reactants?
- a. Cellular Respiration
 - b. Fertilization
 - c. Mechanical Digestion
 - d. Translation
12. In a cell, a phosphate group is added to ADP to form ATP. Which of the following **best** describes the importance of the formation of ATP?
- a. It connects amino acids.
 - b. It provides energy for the cell.
 - c. It creates new polysaccharides.
 - d. It catalyzes chemical reactions
13. When *Streptococcus pneumoniae* are exposed to an antibiotic, the bacteria try to pump the antibiotic out of their cells. Which of the following mechanisms is most likely used by the *Streptococcus pneumoniae* to pump the antibiotic out of their cells?
- a. Active transport
 - b. Diffusion
 - c. Facilitated diffusion
 - d. Osmosis
14. Which of the following is a difference between active and passive transport?
- a. Passive transport uses intermembrane protein.
 - b. Active transport is not used in cells.
 - c. Active transport requires energy.
 - d. Passive transport is only used for water
15. Which of the following sequences represents chromosome number during fertilization?
- a. $2N \rightarrow N + N$
 - b. $N + N \rightarrow 2N$
 - c. $N \rightarrow N$
 - d. $2N \rightarrow 2N$
16. Lung cancer cells do not respond to the signals that regulate the growth of normal cells. Which of the following processes is **not** appropriately regulated in the cancerous cells?
- a. Fertilization
 - b. Meiosis
 - c. Mitosis
 - d. Transpiration
17. Dogs have 78 chromosomes. How many chromosomes should be in a **sperm cell** of a male dog?
- a. 78
 - b. 39
 - c. 19.5
 - d. 156
18. Which of the following occurs in meiosis, but not in mitosis?
- a. Chromosomes coil and condense.
 - b. Spindle fibers form across the cell.
 - c. Haploid cells are formed.
 - d. The nuclear membrane breaks down.

